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(73) Proprietor: **EASTHORPE INVESTMENTS Ltd.**
Mercantile House Ridgeway Street
Douglas Isle of Man(GB)

(72) Inventor: **Palliser, Alfred Milbanke Hudson**
Dixcart Cottage
Sark-Channel Islands(GB)

(74) Representative: **Modiano, Guido et al**
MODIANO, JOSIF, PISANTY & STAUB
Modiano & Associati Via Meravigli, 16
I-20123 Milano(IT)

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Description

The present invention relates to a centrifugal pump particularly suitable for use with washing machines, dishwashers or other similar household appliances which provide liquid discharge operating cycles.

Centrifugal pumps of the known kind, usually employed in household appliances such as dishwashers and washing machines, are generally composed of an asynchronous motor combined with a centrifugal pump the impeller of which is positioned in a sealed chamber.

In practice the axle of the electric motor enters the pump body with the interposition of an annular or toroidal liquid seal which prevents the liquid from flowing out.

This seal represents one of the most critical points of the motor-to-pump coupling and the leakage of liquid through this seal is one of the most frequently occurring and damaging failures, as it usually results in the electric motor being damaged.

It should be further considered that the pump, particularly if installed in washing machines for domestic use, is affected by a liquid which carries in suspension sand and dust which produce a damaging abrasive effect, especially on the seals in the moving parts, and fiberous matter which by twisting around the impeller and the axle of the pump cause remarkable inconveniences which may even entail the jamming of the pump itself.

The problem of a jammed pump in a household appliance is not a minor one because, additionally to blocking the machine, it requires the intervention of highly specialized personnel also because of the notable complexity due to the hydraulic sealing and centering means themselves.

Also from a production standpoint, the making of asynchronous motors and their subsequent association with pumps of the centrifugal kind, having a separate structure, turns out to be particularly expensive and may imply very difficult assembly.

GB-A-2024528 shows a centrifugal pump for small throughputs as defined in the pre-characterizing portion of appended claim 1. DE-A-2207647 shows a rotor shaft, with impeller and rotor of an electric motor rigidly connected thereto, which is rotatably supported by cylindrical bearings. A housing support comprises a compartment in which the bearings and rotor are arranged which is in fluid contact, first through a filter and then through holes in the housing support, with a compartment in which is arranged the impeller.

The primary purpose of the present invention is to eliminate the above described disadvantages in known kinds of centrifugal pumps, by providing a centrifugal pump which, because of its peculiar characteristics, is capable of ensuring complete hydraulic sealing of the liquid, eliminating any possibility of leakage, without however necessarily entailing the use of particular sealing means.

Within the scope of the above described aim, a further object of the invention is to provide a centrifugal pump which combines the preceding characteristic with the characteristic of being endowed with a remarkable simplicity in the centering thereof.

Another object is to provide a pump structured in such a way as to be only minimally affected by the presence of sand, dust or fibrous matter suspended in the liquid being pumped.

A further object is to provide a centrifugal pump composed of readily available parts, which are mass produceable at reduced costs.

A not least object is to provide a pump which, though being capable of offering the most ample guarantees of reliability and safety in use, has a very modest global cost which may contribute towards its popularity among potential users.

The above described aim, as well as the objects described and others which will become apparent hereinafter are achieved by a centrifugal pump particularly for washing machines, dishwashers and similar household appliances, characterized in that it comprises a pump body and a volute, complementary to each other, which once assembled provide a sealed body defining a first chamber and a second chamber, said first chamber containing a permanent magnet rotor, said second chamber containing an impeller, said rotor and said impeller, being maintained coaxial to each other by centering means, and reciprocally rotatively associated by coupling means, externally to said pump body being provided the stator body of an electric motor.

Further characteristics and advantages of the invention will be more clearly understood by describing three preferred, but not limitative, embodiments of a centrifugal pump according to the invention, illustrated by way of indication and not of limitation in the accompanying drawings, wherein:

Fig. 1 is a perspective view of a first embodiment of the pump, wherein the electric windings of the stator body have been omitted;

Fig. 2 is a view of the same pump of Fig.1, illustrated exploded into its main components;

Fig. 3 is a front view, from the motor side, of the first embodiment of the pump, in which the electric windings of the stator body have been again omitted;

Fig. 4 is a lower three-quarters perspective view of the pump impeller illustrated in the preceding figures;

Fig. 5 is a cross section view according to a plane passing through the longitudinal mid axis

of the impeller;

Fig. 6 is a longitudinal cross section of a constructive variation of the pump illustrated in the preceding figures;

Fig. 7 is an enlarged-scale detail view of the preceding Fig. 6;

Fig. 8 is a perspective view of a second embodiment of a pump according to the invention;

Fig. 9 is a front view from the side of the motor of the same pump shown in Fig. 8 in which the electric windings of the stator body have been omitted;

Fig. 10 illustrates a view of another embodiment of a pump according to the invention, partly cross-sectioned according to a longitudinal plane;

Fig. 11 is an enlarged-scale sectional view taken on a plane passing through the axis of rotation, which illustrates a detail related to the impeller-rotor coupling zone of the pump of fig. 10;

Fig. 12 is an exploded view which illustrates, part-sectioned, the rotor, the damping element and the impeller of the second embodiment of the pump;

Fig. 13 is a front view of the top part of the rotor which points out its damped connection to the impeller;

Fig. 14 is a cross sectional view, in an enlarged scale, of a detail of the impeller-rotor coupling of the embodiment of the pump illustrated in Figure 10;

Fig. 15 is a constructive variation of the impeller-rotor cluster, relative to the embodiment of the pump illustrated in Figures 10 to 14;

Fig. 16 is an enlarged-scale cross section view related to a different constructive variation of the rotor-impeller coupling;

Fig. 17 is a front view of the top part of the rotor, which illustrates a further variation of the coupling to the impeller; and

Fig. 18 illustrates a further embodiment of a centrifugal pump according to the invention.

With reference to the figures 1 to 5, a first embodiment of a centrifugal pump according to the invention, generally indicated with the reference numeral 1, comprises a sealed body essentially composed of a pump body 2 and a volute 3, sealingly associable and complementary to each other.

The pump body 2 comprises a cylindrical portion 4 which in its interior defines a first sealed chamber 5, there being endowed with a concentrical area 7 at its closed base 6, which area 7 has a reduced diameter.

Internally of the first chamber 5 is a rotor 8 with permanent magnets 9 downwardly provided with a centering section 10 shaped matchingly to the r - duced area 7; on the opposite side of the rotor 8 ther being provided an engagement means for an impeller 11 composed of a radially protruding tooth 12.

The depth of the first sealed chamber 5 is slightly greater than the length of the rotor 8 and from its open base and perpendicular thereto, extends a plate-like portion 13 having, on the opposite side to the cylindrical section 4, a raised element 14 in the shape of a circular crown, concentric to the axis of the first chamber 5 and provided with a seat for a seal such as, for example an O-Ring 15.

On the outer surface of the cylindrical portion 4, from the plate-like portion 13, a plurality of longitudinal ridges 16 extend, which limit the position of maximum insertion of the stator laminations 17, which bears electric windings, not illustrated, of an electric stator body which therefore is positioned externally relatively to the first sealed chamber 5.

The centrifugal impeller 11 has a plurality of radial blades, which extend from an impeller body 19, the base thereof having a diameter slightly smaller than that of the raised element 14; it should further be noted that the impeller body 12, is provided at the central axis thereof, with a substantially cylindrical axial bore 20.

On the opposite side to the blades 18, from the impeller body 19 extends a means for engagement with the rotor 8, comprising a lug 21 adapted for interacting with the tooth 12 and, substantially proximate to the axial bore 20, protrudes downward a cylindrical centering element 22, matchingly shaped to a cavity 23 provided at the top end of the rotor 8.

Expediently, the lug 21 defines the shape of an arc of a circle, with an external diameter slightly smaller that that of the first sealed chamber 5, inside which it is insertable.

Furthermore the impeller 11 is provided, on its impeller body 19, with one or more passages 24. On the outer part of the plate-like portion 13 of the pump body 2 are provided one or more means for engagement with the volute 3, essentially composed of protruding portions 25 advantageously provided with a threaded bore.

The volute 3 is shown to be composed of a box-like body 26, with an essentially cylindrical shape, sealingly and removably associable with the pump body 2; the box-like body 26 may in fact be suitably provided with an annular base 27 associable with the plate-like portion 13 and having an internal diameter approximately equal to the outer one of the raised element 14.

Perpendicularly to the annular base 27 is present a plurality of connection means, suitably composed of perforated cylindrical sections 28 which can be made to coincid with the protruding

sections 25, by rotating through an appropriate angle the position of the volute 3 relatively to that of the pump body 2.

The box-like body 26 defines in its interior a second sealed chamber 29 for containing the impeller 11.Above said second sealed chamber 29 is provided on the box-like body 26 a first opening 30 communicating with a suction conduit 31.

To the walls of the first opening 30 is rigidly coupled a centering means, which does not close this first opening, composed of a cylindrical element 32 from which extends a stem-like portion 33 protruding inside the second sealed chamber 29 and matchingly shaped to the axial bore 20 provided in the impeller body 19; the axis of this stem-like portion 33, therefore, coincides with that of the first sealed chamber 5.

On the side wall of the box-like body 26 is provided a second opening 34; whereto a delivery conduit 35 extends.

The plate-like portion 13 of the pump body 2 is provided with one or more bores 36 for means for fixing a support, if required.

The assembly and the operation of the above described embodiment 1 is therefore the following: initially, inside the first chamber 5 the rotor 8 will be positioned, by positioning the centering portion 10 in the provided reduced-diameter zone 7, so that the tooth 12 is positioned proximate to the plate-like portion 13.

Subsequently, the impeller 11 will be positioned, taking care to locate the cylindrical element 22 inside the cavity 23 provided on the rotor 8; this allows excellent centering of the impeller itself while the passages 24, by aiding in the initial passing of fluid inside the first sealed chamber 5, allows for self-centering of the rotor 8, forming between the chamber 5 and the cylindrical section 4 a film of liquid, such as, e.g., water.

Motion is transmitted from the rotor 8 to the impeller 11 by means of the interaction of the tooth 12 with the lug 21.

The subsequent phase of the assembly will be composed of stacking the volute 3 on top of the pump body 2, by inserting the stem-like portion 33 in the axial bore 20 provided on the impeller 11; this arrangement allows excellent centering of the elements which constitute the pump, both rotor and impeller having the same rotation axis.

The seal between the pump body 2 and the volute 3 is provided by virtue of the shape of the annular base 27, which, as it is partially matchingly shaped to the raised element 14, is endowed with a step-like discontinuity; furthermore, between the annular base 27 and the raised element 14, is furthermore accordingly placed a safety seal of a known kind, available on the market, such as, e.g., the O-Ring 15.

The position of the delivery conduit 35 can be chosen according to actual requirements, due to the presence of a plurality of cylindrical sections 28, rigidly coupled to the plate-like portion 13; it will indeed be sufficient to rotate the volute 3 on the plate-like portion 13 to have the protruding sections 25 and the cylindrical sections 26 coincide and join them to each other, according to requirements, either with a self-threading screw, or with a nut and associated bolt (not illustrated).

The plate-like portion 13 may be associated to a provided support by means of fixing means insertible into the holes 36 and therefore the stator body of the electric motor can be associated by inserting the cylindrical section 4 within its stator laminations 17 until it engages with the longitudinal ridges 16.

In the following Figs. 6 and 7 is shown a constructive variation, generally indicated by reference numeral 101, of the centrifugal pump above described.

In the same, the rotor 108 and the impeller 111 are provided with a common centering means composed of a pin 137, advantageously of steel, which extends on the inside of the axial bore 120 of the through cavity 123, and has a diameter such that it allows for the rotation of the rotor 108 and of the impeller 111.

A first end 138 of the pin 137 is inserted and locked in a matchingly shaped cylindrical seat 139 provided at the closed base 106 of the cylindrical section 104.

The second end 140 of the pin 137 is provided with an annular groove 141, which acts as a seat for a matchingly shaped locking element 142 associable with the second end itself.

Said locking element 142 is located in a matchingly shaped widened area 143, provided at the top of the impeller 111, proximate to the suction conduit 130, and prevents the impeller itself from performing axial movements in such a direction.

Advantageously, the radial blades 118 of the impeller 111 define a height dimension equal to that of the second sealed chamber 129 in order to avoid any possible winding of fiberous matter around the impeller 111.

Another embodiment of a centrifugal pump according to the invention is illustrated in Figs. 8 to 14.

Also in this embodiment, the pump, generally referred to with the reference numeral 201, is composed of a pump body 202 complementary and associable, for example by means of screws, to a volute 203 which once assembled provides a sealed body xpediently having an axial suction conduit 231, and a radial delivery conduit 235.

Both these conduits are provided in the volute

203 together with a box-like body 226 for the impeller 211, radiused towards the delivery opening.

The pump body 202 is substantially composed of a plate-like portion 213 perpendicular to a cylindrical portion 204 which contains the rotating part of the motor, which will be subsequently illustrated, and is encircled externally by the stator laminations 217 on which the stator body windings 244 are wound, which end with two electric connectors 245.

In order to keep in correct position the stator laminations 217 relatively to the cylindrical portion 204, the latter is provided with two centering fins 246 which act as an abutment for the front part of the stator 217, determining the position thereof.

In Fig. 10 is illustrated an analogous solution for the pump, wherein the only difference, relatively to the figures 8 and 9, is represented by the different position of the suction conduit, again indicated at 231, which now, though it axially couples with the box-like body 226 of the volute 203, is thus curved so as to extend parallel to the plate-like section 213.

These different configurations can anyway be chosen according to the installation of the pump in the household appliance.

Inside the sealed body defined by the pump body 202 and by the volute 203, and more in particular inside the cylindrical section 204, is contained a rotor 208 with permanent magnets 209 which is axially provided with a cylindrical through cavity 223, traversed by a fixed supporting and guiding pin 237, the first end thereof 238 being forced and blocked into a cylindrical seat 239 provided in the closed base 206 of the cylindrical section 204.

In this solution, therefore, the pin 237 is shown to be fixed and the rotor 208 is free to rotate, supported and guided by the pin itself.

It should suitably be noted that the rotor 208 may be advantageously obtained by injection of a plastic material into a mould, wherein the permanent magnets are positioned as inserts.

In order to allow low friction and an excellent centering of the rotor 208, the cylindrical through cavity 223 has, at its two ends 247 and 248, a diameter which is smaller than that which can be found in the intermediate area 249, so as to practically create only two sliding areas, indicated at 250.

With this solution it is not necessary to provide any element interposed between the rotor 208 and the fixed pin 237.

In its part proximate to the plate-like portion 213, the rotor 208 is provided with a deep annular cavity 251, having internally peripheral teeth 252 which allow for the positioning of a sector 253, and may be made of material such as rubber or elastomer, and advantageously provided with a matchingly shaped set of teeth which holds it still within the cavity 251, in the position it was inserted in.

Said rotor 208 is further provided with a toroidal protruding edge 254 which, as will be seen, will be suitable for hooking to the impeller 211.

The impeller 211, of the centrifugal type, is provided with, in the illustrated case, four radial blades 218, arranged at 90 degrees respectively, associated to an impeller body 219, provided internally with an axial bore 220, adapted for containing a cylindrical extension 255 of the rotor 208.

The impeller body 219 is further provided with an annular groove 256 which is adapted for containing the top area of the rotor 208 and, in particular, the toroidal edge 254 which is therefore blocked by an annular edge 257, present inside the annular groove 256.

It is furthermore important to notice the fact that from the impeller body 219 a lug 221 extends, which inserts within the annular hollow 251, in the space unoccupied by the rubber section 253.

In practice the impeller 211 may be provided in a plastic material and, by making use of this material's deformability, it can be associated to the rotor 208, by means of slight temporary elastic deformations which allow for the engagement between the toroidal edge 254 and the annular ridge 257.

This configuration of parts, as is more clearly illustrated in Fig. 14, allows for a safe engagement of the impeller 211 to the rotor 208, leaving however the impeller itself 211 free to rotate relatively to the rotor 208 and vice versa.

The entrainment of the lug 211 due to the motion of the rotor 208 occurs when the lug 221 is in abutment with the elastic section 253.

Also this configuration of parts has been studied allowing for the fact that an electric motor with a permanent magnet rotor is substantially of the synchronous type, and, upon starting, in order to attain synchronization must be endowed with the smallest possible start-up or starting resistance.

Thus in practice the impeller 211 is disengaged from the rotor 208 for an arc smaller than 360 degrees and the start-up, which can occur indifferently in a clockwise or an anticlockwise direction, occurs practically while the impeller is still; only when the motor is running and the section 253 engages with the lug 221 is the impeller 211 taken along in the motion.

The section 253 is advantageously provided in an elastic material, so that when it engages with the appendix 221 it is capable of absorbing the impact and of eliminating the noise due to the connection.

It should furthermore be noted that the lower

edge 258 of the impeller body 219 is extended so as to substantially touch the inside face of the plate-like portion 213, assuming, when the impeller and the rotor are not moving, the position, indicated in broken lines and with the numeral 259 in Fig. 14.

In this manner any intake of dust or foreign matter in the interspace between the rotor 208 and the cylindrical portion 204 is prevented, which would entail the degrading of the sliding areas 250 between the rotor 208 and the fixed pin 237.

Once start-up has occurred, due to the depression in suction, the impeller rises, as illustrated in Fig. 14, and detaches from the internal face of the plate-like section 213 and therefore allowing for a rotation devoid from any dragging whatsoever.

It should be noted that the section of the rotor 208 within the cylindrical section 204 is stably defined by the magnetic action of the permanent magnets 209 relatively to the stator laminations 217; there is therefore the possibility of a single elastic shifting as opposed to the magnetic and electromagnetic forces, mutually attractive between the stator laminations 217 and the permanent magnets 209.

It should further be noted how the entire pump is structured in a completely symmetrical manner, both in the impeller 211 and in the second sealed chamber 229 which contains the impeller itself, since the start-up procedure can occur indifferently both in a clockwise and in an anticlockwise direction.

This fact is particularly advantageous since if the impeller should find an obstacle in a direction of rotation which causes the stopping thereof, the motor can simply resume turning in the opposite direction, thus getting rid of the obstacle and expelling it.

This occurs in particular when the pump is employed in washing machines where it is possible to find fiberous matter which can wrap around the impeller until it is stopped; at this point the motor, by restarting in the opposite direction, unwraps the fiberous matter, gets rid of the same and expels it.

In the following Figures 15, 16 and 17 are illustrated constructive variations related to the embodiment of the pump, which has just been illustrated.

In particular, in the first variation shown in Fig. 15, the rotor 308 is still of the permanent magnet kind, practically identical to the one 208 already illustrated, it also having an annular cavity 351 in which is inserted an elastic section 353 associated with an impeller 311 perfectly identical to the one previously described.

The constructive differenc lies in the fact that the nds of the through cavity 323 of the rotor 308 are widened and suitable for containing two metallic bearings 360 preferably of the cylindrical and self-centering type, which have the function of allowing for a perfect sliding of the pin which, for greater clarity, is not indicated but is perfectly identical for function and position to the pin 237 already illustrated.

Such a variation can be advantageous when the plastic material in which the rotor is provided has insufficient mechanical characteristics, so that there is a danger of a rapid wear by sliding on the fixed pin.

In the subsequent Fig. 16 is illustrated a second constructive variation, related to the transmission of the motion between the rotor 408 and the impeller 411, which are still connected to each other by means of the engagement of the toroidal edge 454 of the rotor with the annular ridge 457 within the groove 456 of the impeller 411.

In this variation, the impeller and the rotor are devoid of lugs or teeth which directly engage one another, but are instead associated by a spiral spring 461 which, positioned coaxially to the cylindrical extension 455, has its end sections 462 and 463 respectively fixed to the impeller body 419 and to the bottom of the annular cavity 451 of the rotor 408.

At the start-up of the impeller 408 the spring 461 elastically deformates by torsion, allowing the rotor itself to move through a rotation angle while the impeller 411 is practically still, which allows it to attain a speed sufficient to subsequently take along the impeller 411.

In this manner the possibility is kept of rotating both in a clockwise and in an anticlockwise direction, and furthermore the connection between the rotor 408 and the impeller 411 becomes even more damped, so that, since the two elements are constantly coupled by an elastic means, any possible beating or vibrations, which could ensue for example when the pump is not completely full of water, but has air pockets with a different and variable resistance in the course of time, are eliminated in an even more efficient manner.

A further constructive variation to the embodiment of the centrifugal pump is illustrated in the subsequent figure 17 and refers again to the elastic connection between the impeller 511 and the rotor 508.

In such a variation, inside the annular cavity 551 of the rotor 508 is present a fixed radial tooth 512, against a side of which a spiral spring 564 engages, which spring extends with a curved extension along the bottom of the same annular cavity 551.

At its opposite end the spring 564 engag s against the side of a lug 521, shown in cross-section, which, extending from the impeller, inserts into the cavity 551, and presses said lug against

the radial tooth 512.

In such a variation, when the rotor 408 tends to start-up in the direction which causes its tooth 512 to move away from the lug 521, a compression is obtained of the spring 564 which allows the rotor 508 a small stroke with the impeller stopped, sufficient to achieve the synchronicity speed required for start-up.

Instead, in the case in which the rotor 508 tends to start up in the opposite direction, due to the direct engagement between the tooth 512 and the lug 521, it should instantaneously start the impeller rotating also; however, as the rotor 508 is not capable of giving a sufficient acceleration, the start-up in this direction does not occur and the entire cluster restarts in the opposite direction.

With the described variation an excellent elastic coupling between the rotor and the impeller has been achieved, and at the same time a single possible pump rotation direction has been fixed.

A further embodiment of a pump according to the invention is illustrated in Fig. 18, wherein the parts are studied with a particular care for the necessity of avoiding the introduction of sand or foreign matter in the area affected by the rotor and by the sliding bearings.

In this case the axial pin, now indicated with the numeral 637, is no longer fixed but is rigidly coupled to the impeller 611 with which it rotates during the motion.

Said pin 637 is supported underneath by a first self-centering bearing 665 rigidly coupled to a reduced-diameter area 607 provided at the closed base 606 of the cylindrical section 604.

During assembly, a sealing plate 666 is inserted upwardly, it also being provided in its central area with a second self-centering bearing 667 which supports and guides the axial pin 637.

For greater safety, a sliding seal 668 can be suitably provided, which performs a seal against foreign matter in the area in which the pin 637 protrudes from the second bearing 667.

The rotor 608 is mounted free on the pin 637 and in its lower area is provided with a tooth 669 which interferes with a radial lug 670 rigidly associated with the pin 637.

Also in this case the start-up of the rotor 608 can occur both in the clockwise and in the anticlockwise direction, and the engagement with the impeller 611, rigidly associated with the pin 637, occurs after an angle of free rotation.

The first sealed chamber 605 affected by the rotor 608 can also be full of liquid, since the function of the sliding seal 668 and of the plate 666 is not so much to prevent liquids from flowing in, as it is to prevent th entry of foreign matter, such as sand, dust and the like.

From what has been described and illustrated, in the various proposed versions, it should be noted that all the preset objects have been achieved and in particular that a pump has been provided particularly suitable for use in household appliances such as washing machines, dishwashers etc., with excellent mechanical and electric characteristics.

It should be noted, in fact, that the electric part is completely external to the area affected by the liquid, while no sliding seals have in any way been provided to separate internal areas from external areas, thus eliminating any problem of liquid leakage which could wet and irreparably damage the electric winding.

For this reason a grounding protection is no longer even necessary, since the powered parts are doubly insulated from the liquid flowing in the pump itself.

The components of the pump are associable to each other in a very simple, rapid and removable manner, without requiring particular constructive difficulties. The centering means, located on the pump components, allow for the obtainment of an optimum and silent operation and the extreme constructive simplicity as well as a rapid assembly also allows for a easy and quick maintenance.

It should still be noted that the moving parts have been protected from wear due to sand, dust, etc. or other foreign matter carried in suspension in the liquid.

The employment of a permanent magnet rotor has allowed to drop considerably the power required by the pump while the possibility of starting up and rotating indifferently in the two directions entails again remarkable advantages suitable to avoid blocking and jamming problems.

As far as the hydraulic characteristics of the pump are concerned, since it is operated by a synchronous motor, it allows for a constant flow as the power supply voltage varies, with remarkable advantages in the size thereof and of the household appliances to which it is to be associated.

Claims

1. Centrifugal pump particularly for washing machines, dishwashers and similar household appliances, comprising a pump body (2;202) and a volute (3;203) mutually connected to one another to provide a sealed body, a permanent magnet rotor (8;108;208;308;408;508;608) and an impeller (11;111;211;311;411;611) mutually associated by coupling means (12,21;221,252-257;353;454-457,461;512,521,564;637) and rotatably maintained in said sealed body by centering means (22,23,32,33;137;237;637), said pump body defining a first cylindrical chamber (5;605) of said sealed body in which

said rotor is arranged, said volute defining a second chamber (29;129;229) of said sealed body in which said impeller is arranged, a stator body (17;217) of an electric motor being provided externally to said pump body, characterized in that a plate-like portion (13;213) is connected to said first cylindrical chamber at one end thereof, a raised element defining a circular crown (14) being provided on said plate-like portion and being concentric to the axis of said chamber, said impeller having a circular impeller body (19;219;419) with an external diameter slightly smaller than the internal diameter of said circular crown so as to be arranged snugly therein, the lower edge of said impeller body, after assembly, practically flanking the internal part of said plate-like portion, thus preventing the passage of foreign matter from said second chamber to said first chamber, said rotor being arranged in said first cylindrical chamber so as to form between the external wall of the rotor and the internal wall of the chamber an interstice, which is in hydraulic connection with the fluid circulating in said second chamber, said rotor having an external diameter and a length slightly smaller than those of said first chamber so that the dimensions of said interstice are such that the liquid in said interstice forms a film substituting for usual mechanical supporting or bearing means.

2. Pump according to claim 1, further comprising an axial suction conduit (31) and a radial delivery conduit (35) provided on said volute (3), further characterized in that said plate-like portion (13) has perimetrally at least two protruding, drilled sections (25) associable to cylindrical drilled sections (28) extending from said volute (3), so as to allow for the directable hooking between said volute (3) and said pump body (2).

3. Pump according to one or more of the preceding claims, characterized in that said pump body (2) is a cylindrical portion (4) having at its closed base (6) opposite to said plate-like portion (13), a concentric area (7) with a reduced diameter for a matchingly shaped centering section (10) of said rotor (8).

4. Pump according to one or more of the preceding claims, characterized in that said circular crown (14) has a seat for a means for sealing (15) with said volute (3), said volute being composed of a box-like body (26) having a diameter intermediate to that of said circular crown (14) and having an annular base (27), said annular base being connectable with said plate-like element (13) and being made to overlap said circular crown (14) by means of an area having a step-like discontinuity.

5. Pump according to one or more of the preceding claims, characterized in that said centering means comprise a hollow cylindrical cavity (23) in said rotor (8) with an axis coinciding with the rotor axis and matchingly shaped with a cylindrical centering element (22) protruding from the bottom of said impeller body (19), said coupling means comprising a radially protruding tooth (12) of said rotor (8) and an engagement lug (21) of said impeller body (19), said lug (21) having the shape of the arc of a circle and an external diameter concentrical and slightly less than that of said first chamber (5), said centering means further comprising a cylindrical element (32) connected to the internal lateral surface of said suction conduit (31) by means of one or more radial small bridges, said cylindrical element (32) having a stem like portion which is insertable in an axial bore (20) in the central axis of said impeller (11).

6. Pump according to one or more of the preceding claims, characterized in that through passages (24) are provided in the impeller body (19) of the impeller (11) for allowing fluid devoid of damaging particles to communicate between said first chamber (5) and said second chamber (29).

7. Pump according to one or more of the preceding claims, characterized in that said impeller (11) comprises fins (18) associated with the impeller body (19).

8. Pump according to one or more of the preceding claims, characterized in that said centering means are common to said rotor (108) and said impeller (111) and comprise a pin (137) insertable into through seats (120,123) provided along the longitudinal axis in said rotor (108) and said impeller (111), an end (140) of said pin being provided in an annular groove (141) engaging with a matchingly shaped blocking element (142), the other end (138) being rigidly associated within a matchingly shaped cylindrical seat (139) provided at the closed base (106) of said cylindrical section (104), said locking element (142) being positioned in a widened matchingly shaped area provided at the end of said impeller body facing said suction conduit (138).

9. Pump according to one or more of the preceding claims, characterized in that th stator laminations (17) and the stator body windings which are positioned externally to said cylindrical section (4) are encircled by polar expansions, said cylindrical section (4) being externally provided with longitudinal ridges (16) extending towards said plate-like portion (13) in order to define the reciprocal insertion position between said stator laminations and said cylindrical portion.

10. Pump according to claim 9, characterized in that said stator laminations (217) are kept in position by centering fins (246) present on the outer surface of said cylindrical portion (204) and positioned at the front edges of said stator laminations (217), for which they constitute abutment.

11. Pump according to one or more of the preceding claims, characterized in that said rotor (208) is provided with a cylindrical through cavity (223) suitable for containing a supporting and guiding pin (237) rigidly fixed in a cylindrical seat (239) in the closed base (206) of the cylindrical section (204), said through cavity (223) presenting two extreme areas (247,248) with a diameter substantially equal to the diameter of said pin and an intermediate zone (249) with a larger diameter, said extreme areas constituting the centering means of the rotor.

12. Pump according to one or more of the preceding claims, characterized in that said rotor is connected to said impeller by damped connecting means.

13. Pump according to claim 12, characterized in that said rotor has, in its area on the side of the impeller, an external toroidal border (254,454), suitable to constitute an element for hooking to said impeller, the impeller body thereof being provided with an annular groove (256,456) suitable for containing the top part of said rotor, hooking on to it by means of an internal annular ridge (257,457) engaging in said toroidal edge.

14. Pump according to claim 13, characterized in that said impeller after hooking to said rotor is free to rotate relatively to the latter, as the hooking in not a stable association.

15. Pump according to claim 13, charact rized in that said annular cavity (251) is internally provided with teeth (252), in said hollow (251) there being inserted an elastic section (253) which occupies a reduced corner thereof, said impeller being provided with a lug (221) suitable for inserting itself in said annular hollow and freely rotatable for an angle smaller than 360 degrees, interfering with said elastic section which determines the entrainment during the motion.

16. Pump according to claim 13, characterized in that said rotor and said impeller are elastically connected by a torsion-deformable helical spring (461), coaxially arranged to a cylindrical extension (455), internally limiting said annular hollow (451) of said rotor, and their internal portions (462,463) respectively rigidly connected to the bottom of said hollow (451) and to said impeller body (419).

17. Pump according to claim 13, characterized in that in said annular hollow (551) is present a radial tooth (512) against which a compression-deformable spring (544) is engaged which, extending along said hollow (551), engages, at its opposite end, with a lug 521, extending from said impeller body and inserted in said hollow, pressing the lug against said radial tooth.

18. Pump according to one or more of the preceding claims, characterized in that said rotor is provided by injection of plastic material with permanent magnets as inserts.

19. Pump according to one or more of the preceding claims, characterized in that said impeller has means for preventing the entry of granular products into said first chamber in order to protect the sliding areas of said rotor on the fixed supporting pin.

20. Pump according to one or more of the preceding claims, characterized in that the cylindrical through cavity (323) of said rotor (308) has two ends with a greater diameter, in said ends there being inserted two bearings (360) suitable for constituting the sliding elements with said fixed pin.

21. Pump according to one or more of the preceding claims, characterized in that said fixed central pin (637) is rigidly associated to said impeller (611) and mounted on a pair of self-centering bearings (665,667), while said rotor (608) is mounted free on said pin, said rotor being provided with a lug (670) on one of the two heads, said lug interfering with the radial tooth (669) rigidly associated to said rotor, the interference between said lug and said tooth

determining the entrainment of said impeller during the rotation of said rotor.

22. Pump according to claim 21, characterized in that at least one (665) of said self-centering bearings is mounted at the closed base (606) os said cylindrical portion (604), while the second (667) of said bearings is mounted on a transverse plate (666) interposed between rotor and impeller, said plate furthermore being provided with a sliding seal (668) on said pin, said plate-seal combination preventing the entry of foreign matter or sand towards said bearings.

23. Pump according to one or more of the preceding claims, characterized in that said rotor, said impeller and said second sealed chamber are of symmetrical shape, allowing for the rotation of the cluster both clockwise and anticlockwise without modification of the electric and hydraulic characteristics of the cluster.

Revendications

1. Pompe centrifuge, notamment pour des machines à laver, des lave-vaisselle et des appareils ménagers similaires, comprenant un corps de pompe (2;202) et une volute (3;203) mutuellement raccordés l'un à l'autre pour procurer un corps étanche, un rotor à aimants permanents (8;108;208;308;408;508;608) et une turbine (11;111;211;311;411;611) mutuellement associés par des moyens d'accouplement (12,21;221,252-257;353;454-457,461;512,521,564;637) et maintenus en rotation dans le corps étanche par des moyens de centrage (22,23;32,33;137;237;637), ce corps de pompe définissant une première chambre cylindrique (5;605) du corps étanche dans laquelle est disposé le rotor, la volute définissant une deuxième chambre (29;129;229) de ce corps étanche dans laquelle est disposée la turbine, un corps de stator (17;217) d'un moteur électrique étant prévu à l'extérieur du corps de pompe, caractérisée en ce qu'une portion en forme de plaque (13;213) est reliée à la première chambre cylindrique au niveau d'une de ses extrémités, un élément en relief définissant une couronne circulaire (14) étant prévu sur cette portion en forme de plaque et étant concentrique à l'axe de la chambre, la turbine ayant un corps de turbine circulaire (19;219;419) avec un diamètre extérieur légèrement plus petit que le diamètre intérieur de cette couronne circulair de façon à y être étroitement logé, le bord inféri ur du corps de turbine flanquant pratiquement, après assemblage, la partie intérieure d cett portion en forme de plaque, mpêchant ainsi l passage de matières étrangères en provenance de la seconde chambre jusque dans la première chambre, le rotor étant disposé dans la première chambre circulaire de façon à former entre la paroi extérieure du rotor et la paroi intérieure de la chambre un interstice qui est en communication hydraulique avec le fluide circulant dans la deuxième chambre, le rotor ayant un diamètre extérieur et une longueur légèrement inférieurs à ceux de la première chambre, de telle sorte que les dimensions de cet interstice sont telles que le liquide dans l'interstice forme un film remplaçant les moyens mécaniques usuels de support ou de palier.

2. Pompe selon la revendication 1, comprenant en outre un conduit d'aspiration axial (31) et un conduit de refoulement radial (35) prévus sur la volute (3), caractérisée en outre en ce que la portion en forme de plaque (13) a sur son périmètre au moins deux sections dépassantes percées (25) pouvant être associées à des sections cylindriques percées (28) s'étendant depuis la volute (3) de façon à permettre l'accrochage direct entre la volute (3) et le corps de pompe (2).

3. Pompe selon l'une des revendications précédentes ou selon les deux, caractérisée en ce que le corps de pompe (2) est une portion cylindrique (4) ayant, au niveau de sa base fermée (6) opposée à la portion en forme de plaque (13), une zone concentrique (7) avec un diamètre réduit pour une section de centrage de forme correspondante (10) du rotor (8).

4. Pompe selon l'une ou plusieurs des revendications précédentes, caractérisée en ce que la couronne circulaire (14) a un siège pour un moyen d'étanchéité (15) avec la volute (3), cette volute étant constituée par un corps en forme de caisson (26) ayant un diamètre correspondant au diamètre de la couronne circulaire (14) et ayant une base annulaire (27), cette base annulaire pouvant être raccordée à l'élément en forme de plaque (13) et étant prévue pour recouvrir la couronne circulaire (14) au moyen d'une zone de décrochement.

5. Pompe selon l'une ou plusieurs des revendications précédentes, caractérisée en ce que les moyens de centrage comprennent une cavité cylindrique creuse (23) dans le rotor (8) avec un axe coïncidant avec l'ax du rotor et ayant une forme correspondant à un élément de centrage cylindrique (22) saillant depuis le

fond du corps de turbine (19), les moyens d'accouplement compr nant une dent dépassant radialement (12) du rotor (8) et un talon de coopération (21) du corps de turbine (19), ce talon (21) ayant la forme d'un arc de cercle et un diamètre extérieur concentrique et légèrement inférieur à celui de la première chambre (5), les moyens de centrage comprenant en outre un élément cylindrique (32) raccordé à la surface latérale intérieure du conduit d'aspiration (31) au moyen d'un ou de plusieurs petits ponts radiaux, cet élément cylindrique (32) ayant une portion en forme de tige, qui peut être introduite dans un alésage axial (20) dans l'axe central de la turbine (11).

6. Pompe selon l'une ou plusieurs des revendications précédentes, caractérisée en ce que des passages traversants (24) sont ménagés dans le corps de turbine (19) de la turbine (11) pour permettre à un fluide dépourvu de particules endommageantes de communiquer entre la première chambre (5) et la deuxième chambre (29).

7. Pompe selon l'une ou plusieurs des revendications précédentes, caractérisée en ce que la turbine (11) comporte des ailettes (18) associées au corps de turbine (19).

8. Pompe selon l'une ou plusieurs des revendications précédentes, caractérisée en ce que les moyens de centrage sont communs au rotor (108) et à la turbine (111) et comportent une broche (137) pouvant être introduite dans des sièges traversants (120,123) prévus le long de l'axe longitudinal dans le rotor (108) et dans la turbine (111), une extrémité (140) de cette broche étant pourvue d'une gorge annulaire (141) coopérant avec un élément de blocage de forme correspondante (142), l'autre extrémité (138) étant rigidement associée avec un siège cylindrique de forme correspondante (139) prévu au niveau de la base fermée (106) de la section cylindrique (104), cet élément de blocage (142) étant positionné dans une zone élargie de forme correspondante prévue au niveau de l'extrémité du corps de turbine faisant face au conduit d'aspiration (130).

9. Pompe selon l'une ou plusieurs des revendications précédentes, caractérisée en ce que les tôles de stator (17) et les enroulements du corps de stator qui sont disposés à l'extérieur de cette section cylindrique (4) sont entourés par des prolongements polaires, cette section cylindrique (4) étant pourvue à l'extérieur de nervures longitudinales (16) s'étendant en direction de la portion en forme de plaque (13) afin de définir la position d'introduction mutuelle entre les tôles de stator et la portion cylindrique.

10. Pompe selon la revendication 9, caractérisée en ce que les tôles de stator (217) sont maintenues en position par des ailettes de centrage (246) présentes sur la surface extérieure de la portion cylindrique (204) et disposées au niveau des bords frontaux de ces tôles de stator (217) pour lesquelles elles constituent une butée.

11. Pompe selon l'une ou plusieurs des revendications précédentes, caractérisée en ce que le rotor (208) comporte une cavité traversante cylindrique (223) appropriée pour contenir une broche de support et de guidage (237) fixée rigidement dans un siège cylindrique (239) dans la base fermée (206) de la section cylindrique (204), cette cavité traversante (223) présentant deux zones extrêmes (247,248) avec un diamètre pratiquement égal au diamètre de la broche et une zone intermédiaire (249) avec un diamètre plus grand, ces zones extrêmes constituant les moyens de centrage du rotor.

12. Pompe selon l'une ou plusieurs des revendications précédentes, caractérisée en ce que le rotor est raccordé à la turbine par des moyens de raccordement amortis.

13. Pompe selon la revendication 12, caractérisée en ce que le rotor a, dans sa zone située sur le côté de la turbine, un bord torique extérieur (254,454), approprié pour constituer un élément pour s'accrocher sur la turbine, le corps de turbine étant pourvu d'une gorge annulaire (256,456) appropriée pour contenir la partie supérieure du rotor, s'accrochant sur lui au moyen d'un bourrelet annulaire intérieur (257,457) coopérant avec le bord torique.

14. Pompe selon la revendication 13, caractérisée en ce que, après accrochage au rotor, la turbine peut tourner librement par rapport au rotor, car l'accrochage n'est pas une association stable.

15. Pompe selon la revendication 13, caractérisée en ce que la cavité annulaire (251) comporte à l'intérieur des dents (252), une section élastique (253) étant introduite dans cette cavité (251) et en occupant un coin réduit, la turbine comportant un talon (221) approprié pour être introduit dans cette cavité annulaire et pouvant y tourner librement sur un angle inféri ur à

360°, interférant avec cett section élastique qui détermine l'entraînement pendant le mouvement.

16. Pompe selon la revendication 13, caractérisée en ce que le rotor et la turbine sont élastiquement raccordés par un ressort hélicoïdal déformable en torsion (461), coaxialement disposé sur un prolongement cylindrique (455), limitant intérieurement la cavité annulaire (451) du rotor, les portions extrêmes (462,463) du ressort étant solidarisées respectivement du fond de la cavité (451) et du corps de turbine (419).

17. Pompe selon la revendication 13, caractérisée en ce qu'une dent radiale (512) est présente dans la cavité annulaire (551), dent contre laquelle vient s'appliquer un ressort déformable en compression (544), lequel, s'étendant le long de la cavité (551), coopère au niveau de son extrémité opposée avec un talon (521), partant du corps de turbine et introduit dans cette cavité, appliquant ainsi le talon contre la dent radiale.

18. Pompe selon l'une ou plusieurs des revendications précédentes, caractérisée en ce que le rotor est obtenu par injection de matière plastique avec les aimants permanents servant d'inserts.

19. Pompe selon l'une ou plusieurs des revendications précédentes, caractérisée en ce que la turbine a des moyens pour empêcher l'entrée des produits granulaires dans la première chambre afin de protéger les zones glissantes du rotor sur la broche support fixe.

20. Pompe selon l'une ou plusieurs des revendications précédentes, caractérisée en ce que la cavité traversante cylindrique (323) du rotor (308) à deux extrémité ayant un plus grand diamètre, deux paliers (360) étant introduits dans ces extrémités et constituant les éléments glissants avec la broche fixe.

21. Pompe selon l'une ou plusieurs des revendications précédentes, caractérisée en ce que la broche centrale fixe (637) est solidarisée de la turbine (611) et est montée sur deux paliers auto-centrants (665,667), tandis que le rotor (608) est monté. libre, sur cette broche, la broche étant équipée d'une patte (670) sur l'une des deux extrémités, cette patte interférant avec la dent radiale (669) solidaire du rotor, l'interférence entre la patte t la dent déterminant l'entraînement de la turbine pendant la rotation du rotor.

22. Pompe selon la revendication 21, caractérisé en ce qu'au moins l'un (665) des paliers autocentrants est monté au niveau de la base fermée (606) de la portion cylindrique (604), tandis que le deuxième palier (667) est monté sur une plaque transversale (666) interposée entre le rotor et la turbine, cette plaque étant en outre pourvue d'un joint d'étanchéité glissant (668) sur la broche, cette combinaison plaque-joint d'étanchéité empêchant toute entrée de matière étrangère ou de sable en direction des paliers.

23. Pompe selon l'une ou plusieurs des revendications précédentes, caractérisée en ce que le rotor, la turbine et la deuxième chambre étanche ont une forme symétrique, permettant à l'ensemble de tourner à la fois dans le sens des aiguilles d'une montre et en sens inverse sans modification des caractéristiques électriques et hydrauliques de l'ensemble.

Patentansprüche

1. Zentrifugalpumpe, insbesondere für Waschmaschinen, Geschirrspülmaschinen und ähnliche Haushaltsgeräte, bestehend aus einem Pumpengehäuse (2; 202) und einer Spirale (3; 203), die miteinander verbunden sind, um ein abgedichtetes Bauteil zu bilden, einem Dauermagnetrotor (8; 108; 208; 308; 408; 508; 608) und einem Pumpenrad (11 - 611), die durch eine Kupplung (12 - 637) miteinander verbunden und drehbar in dem abgedichteten Bauteil mittels einer Zentrierung (22 - 637) gehalten sind, wobei das Pumpengehäuse eine erste zylindrische Kammer (5; 605) des abgedichteten Bauteils bildet, in dem der Rotor angeordnet ist, die Spirale eine zweite Kammer (29; 129; 229) des abgedichteten Bauteils bildet, in der das Pumpenrad angeordnet ist, und aus einem Stator (17; 217) eines Elektromotors, der außerhalb des Pumpengehäuses vorgesehen ist, dadurch gekennzeichnet, daß ein plattenförmiges Bauteil (13; 213) an dem einen Ende der ersten zylindrischen Kammer befestigt ist, ein kreisförmiger, erhabener und zur Achse der Kammer konzentrischer Rand (14) an dem plattenförmigen Bauteil vorgesehen ist, daß das Pumpenrad einen Rotationskörper (19; 219; 419) aufweist, dessen Außendurchmesser etwas kleiner als der Innendurchmesser des kreisförmigen Randes ist, so daß er mit dem Rand enger zusammenpaßt, daß der untere Rand des Rotationskörpers nach dem Zusammenbau der Inn nseite des plattenförmigen Bauteils benachbart ist, so daß der Durchtritt von Fremdpartikeln aus der zweiten Kammer in

die erst Kamm r verhindert ist, daß der Rotor in der ersten zylindrischen Kammer derart angeordnet ist, daß zwischen der Außenwand des Rotors und der Innenwand der Kammer ein Zwischenraum gebildet ist, der mit dem in der zweiten Kammer zirkulierenden Strömungsmittel hydraulisch verbunden ist, und daß der Rotor einen Außendurchmesser und eine Länge aufweist, die etwas kleiner sind als die entsprechenden Abmessungen der ersten Kammer, so daß die Abmessungen des Zwischenraums derart sind, daß die Flüssigkeit in dem Zwischenraum einen Film bildet, welcher die üblichen mechanischen Stütz- und Lagermittel ersetzt.

2. Pumpe nach Anspruch 1 mit einem axialen Ansaugkanal (31) und einem radialen Austrittskanal (35) an der Spirale (3), dadurch gekennzeichnet, daß das plattenförmige Bauteil (13) am Umfang wenigstens zwei vorstehende, mit Bohrungen versehene Abschnitte (25) aufweist, die mit entsprechenden zylindrischen Bohrungsabschnitten (28) an der Spirale (3) zusammenwirken, um die Spirale (3) und das Pumpengehäuse (2) unmittelbar aneinander zu befestigen.

3. Pumpe nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß das Pumpengehäuse (2) einen zylindrischen Abschnitt (4) mit einem geschlossenen Ende (6) gegenüber dem plattenförmigen Abschnitt (13) aufweist, wobei ein konzentrischer Bereich (7) mit einem verringerten Durchmesser vorgesehen ist, in den ein Zentrierabschnitt (10) des Rotors (8) greift.

4. Pumpe nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß der kreisförmige Rand (14) einen Sitz für eine Dichtung (15) mit der Spirale (3) bildet, daß die Spirale einen schachtelförmigen Körper (26) aufweist, dessen Durchmesser innerhalb des kreisförmigen Randes (14) liegt und der einen ringförmigen Flansch (27) aufweist, der an dem plattenförmigen Element (13) befestigbar ist und den erhabenen Rand (14) mittels einer abgestuften Schulter überlappt.

5. Pumpe nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß die Zentriermittel eine zylindrische Ausnehmung (23) im Rotor (8) mit einer in der Rotorachse zusammenfallenden Achse aufweist, in die ein zylindrisches Zentrierelement (22) eingreift, das vom Boden des Rotationskörpers (19) vorsteht, daß die Kupplung ein n radial vorstehenden Zahn (12) des Rotors (8) und eine Mitnehmernase (21) am Rotationskörper (19) aufweist, daß die Mitnehmernase (21) die Form eines Kreisbogens aufweist und ihr Außendurchmesser konzentrisch und etwas geringer ist als der der ersten Kammer (5), daß die Zentriermittel ferner ein zylindrisches Element (32) aufweisen, das an der inneren Seitenfläche des Ansaugkanals (31) mittels einer oder mehrerer kleiner radialer Brücken befestigt ist, und daß das zylindrische Element (32) einen schaftförmigen Abschnitt aufweist, der in eine axiale Bohrung (20) in der Mittelachse des Pumpenrades (11) einsetzbar ist.

6. Pumpe nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß im Rotationskörper (19) des Pumpenrades (11) Durchgänge (24) vorgesehen sind, durch welche Strömungsmittel frei von Fremdkörpern zwischen der ersten Kammer (5) und der zweiten Kammer (29) durchtreten kann.

7. Pumpe nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß das Pumpenrad (11) mit dem Rotationskörper (19) verbundene Flügel (18) aufweist.

8. Pumpe nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß die Zentriermittel für den Rotor (108) und das Pumpenrad (111) gemeinsam sind und einen Schaft (137) aufweisen, der in Durchlässe (120, 123) längs der Längsachse des Rotors (108) und Pumpenrades (111) einsetzbar ist, daß ein Ende (140) des Schaftes mit einer Ringnut (141) in ein entsprechend geformtes Halteelement (142) eingreift, daß das andere Ende (138) mit einem entsprechend geformten zylindrischen Sitz (139) in dem geschlossenen Ende (106) des zylindrischen Abschnitts (104) fest zusammenwirkt, und daß das Halteelement (142) in einer entsprechend geformten Erweiterung angeordnet ist, die am Ende des Rotationskörpers dem Ansaugkanal (138) zugekehrt angeordnet ist.

9. Pumpe nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß die Statorbleche (17) mit den Statorwicklungen als Polschuhe von außen den zylindrischen Abschnitt (4) umschließen, der an der Außenseite mit Längsrippen (16) versehen ist, die sich von dem plattenförmigen Bauteil (13) erstrecken und einen Anschlag für die Lage der Statorbl - che an dem zylindrischen Abschnitt bilden.

10. Pumpe nach Anspruch 9, dadurch gekenn-

zeichnet, daß die Statorbleche (217) von Zentrierrippen (246) gehalten sind, die an der Außenfläche des zylindrischen Abschnittes (204) vorgesehen und an den vorderen Rändern der Statorbleche (217) als Anschläge angeordnet sind.

11. Pumpe nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß der Rotor (208) mit einer zylindrischen, durchgehenden Ausnehmung (223) versehen ist, in der ein Stütz- und Führungsschaft (237) angeordnet ist, der an einem zylindrischen Sitz (239) am geschlossenen Ende (206) des zylindrischen Abschnitts (204) befestigt ist, daß die Ausnehmung (223) zwei endseitige Bereiche (247, 248) mit einem Durchmesser aufweist, der im wesentlichen gleich dem Durchmesser des Schaftes ist sowie eine Zwischenzone (249) mit einem größeren Durchmesser, wobei die Endbereiche die Zentrierung des Rotors bilden.

12. Pumpe nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß der Rotor mit dem Pumpenrad mittels einer Dämpfung verbunden ist.

13. Pumpe nach Anspruch 12, dadurch gekennzeichnet, daß der Rotor in seinem Bereich auf der Pumpenradseite einen äußeren ringförmigen Rand (254, 454) aufweist, der ein Element zur Befestigung am Pumpenrad bildet, daß der Rotationskörper mit einer ringförmigen Nut (256, 456) versehen ist, die den oberen Teil des Rotors aufnehmen kann, und daß die Befestigung mittels eines inneren ringförmigen Randes (257, 457) erfolgt, der unter den ringförmigen Rand greift.

14. Pumpe nach Anspruch 13, dadurch gekennzeichnet, daß das Pumpenrad nach Befestigung an dem Rotor gegenüber dem Rotor frei drehbar ist, die Befestigung also lose ist.

15. Pumpe nach Anspruch 13, dadurch gekennzeichnet, daß eine ringförmige Ausnehmung (251) auf der Innenseite mit Zähnen (252) versehen ist, mit denen die Ausnehmung (251) in einen elastischen Sektor (253) einsetzbar ist, der einen Teil des Umfangs einnimmt, und daß das Pumpenrad mit einer Nase (221) versehen ist, die in die Ausnehmung greift und in dieser um einen Winkel kleiner als 360° frei drehbar ist, wobei die Nase mit dem elastischen Sektor zusammenwirkt, der die Antriebsverbindung vermittelt.

16. Pumpe nach Anspruch 13, dadurch gekennzeichnet, daß der Rotor und das Pumpenrad über eine torsions-verformbare Wendelfeder (461) elastisch miteinander verbunden sind, die Feder koaxial an einer zylindrischen Verlängerung (455) und innerhalb einer ringförmigen Ausnehmung (451) des Rotors angeordnet ist, und daß die Federenden (462, 463) jeweils fest mit dem Boden der Ausnehmung (451) und dem Rotationskörper (419) verbunden sind.

17. Pumpe nach Anspruch 13, dadurch gekennzeichnet, daß die Ausnehmung (551) einen radialen Zahn (512) aufweist, an dem eine druckverformbare Feder (544) angreift, die sich längs der Ausnehmung (551) erstreckt und mit ihrem entgegengesetzten Ende an einer Nase (521) angreift, die sich vom Rotationskörper in die Ausnehmung erstreckt und die Nase an den radialen Zahn drückt.

18. Pumpe nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß der Rotor aus Kunststoff mit den Permanentmagneten als Einlagen spritzgegossen ist.

19. Pumpe nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß das Pumpenrad mit Mitteln versehen ist, die den Eintritt von Fremdpartikeln in die erste Kammer verhindern, um die Gleitflächen des Rotors an dem festen Stützschaft zu schützen.

20. Pumpe nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß der zylindrische Durchgang (323) im Rotor (308) zwei Enden mit einem vergrößerten Durchmesser aufweist, in denen zwei Lager (360) einsetzbar sind, welche die Gleitelemente für den festen Schaft bilden.

21. Pumpe nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß der feste zentrale Schaft (637) fest mit dem Pumpenrad (611) verbunden ist und an zwei selbst zentrierenden Lagern (665, 667) angeordnet ist, und daß der Rotor (608) frei auf dem Schaft angeordnet ist und mit einer Nase (670) an einem Ende versehen ist, die mit einem am Rotor fest vorgesehenen radialen Zahn (669) zusammenwirkt, und daß das Zusammenwirken zwischen der Nase und dem Zahn die Antriebsverbindung des Pumpenrades vermittelt.

22. Pumpe nach Anspruch 21, dadurch gekennzeichnet, daß mindestens eines (665) der selbstzentrierenden Lager an dem geschlosse-

nen Ende (606) des zylindrischen Abschnittes (604) angeordnet ist und das zweite Lager (667) an einer Querplatte (666) vorgesehen ist, die zwischen dem Rotor und dem Pumpenrad liegt, und die mit einer Gleitdichtung (668) für den Schaft versehen ist, wobei die Kombination Platte-Dichtung den Eintritt von Fremdpartikeln, bzw. Sand in die Lager verhindert.

23. Pumpe nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß der Rotor, das Pumpenrad und die zweite abgedichtete Kammer symmetrisch sind, so daß die Drehung dieser Baueinheit im Uhrzeigersinn und im Gegenuhrzeigersinn möglich ist, ohne daß die elektrischen und hydraulischen Eigenschaften modifiziert werden.

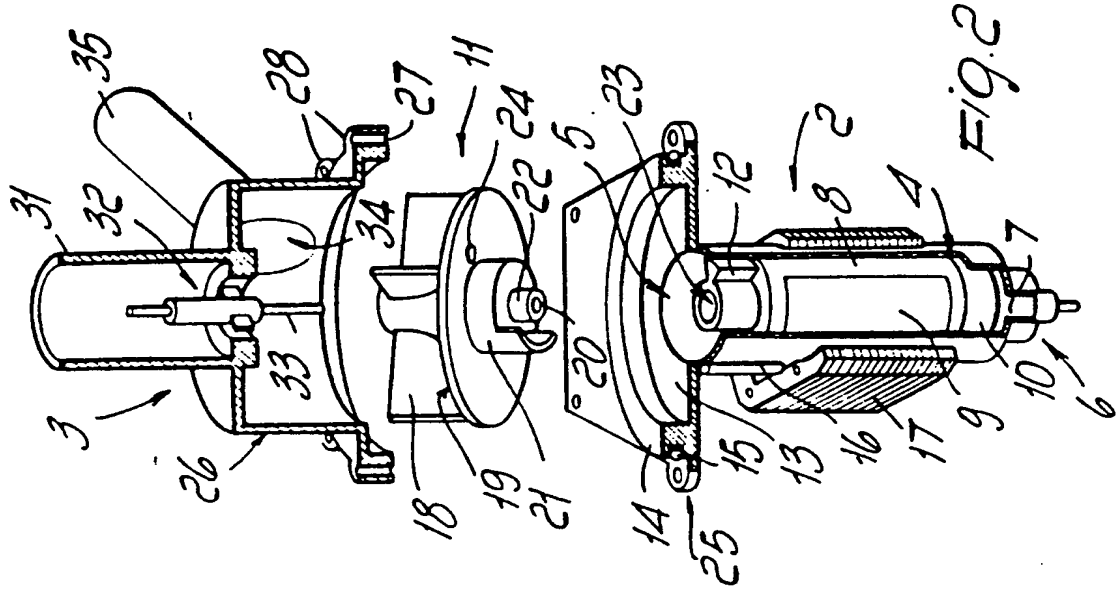
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Fig.2

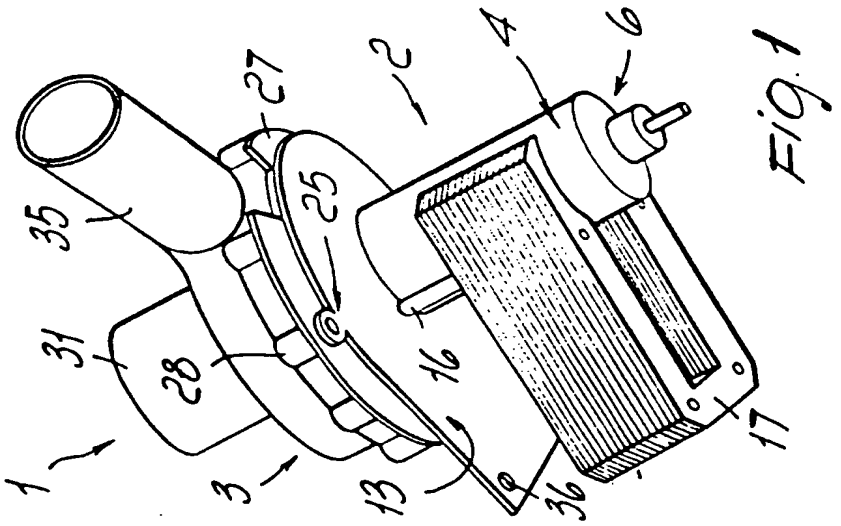
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Fig.1

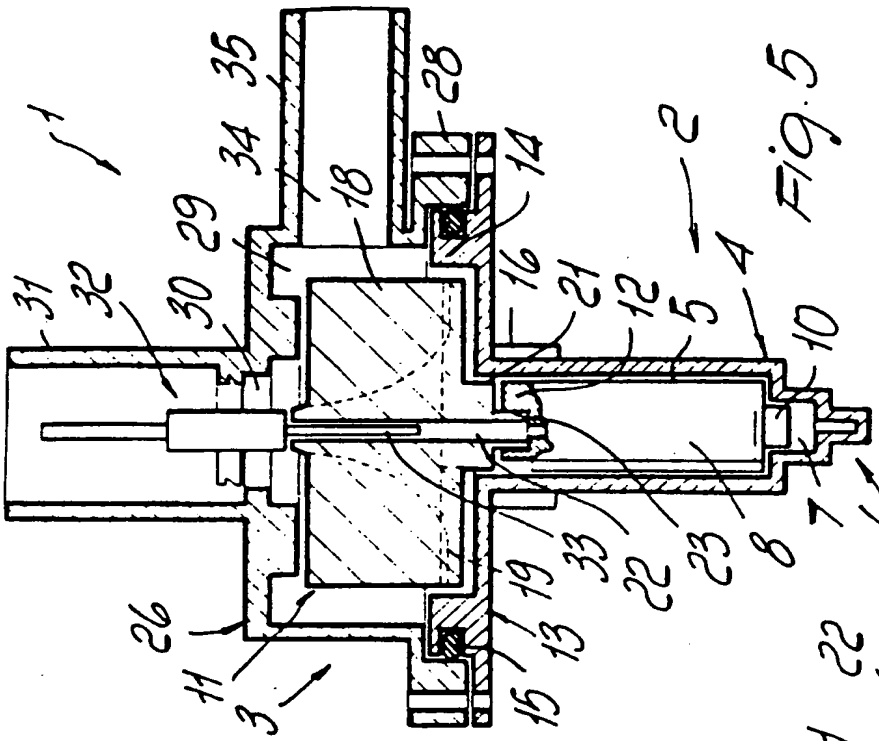
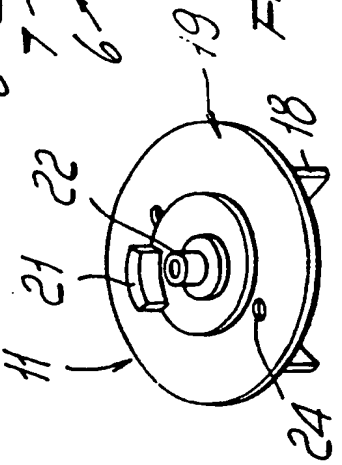


Fig. 5



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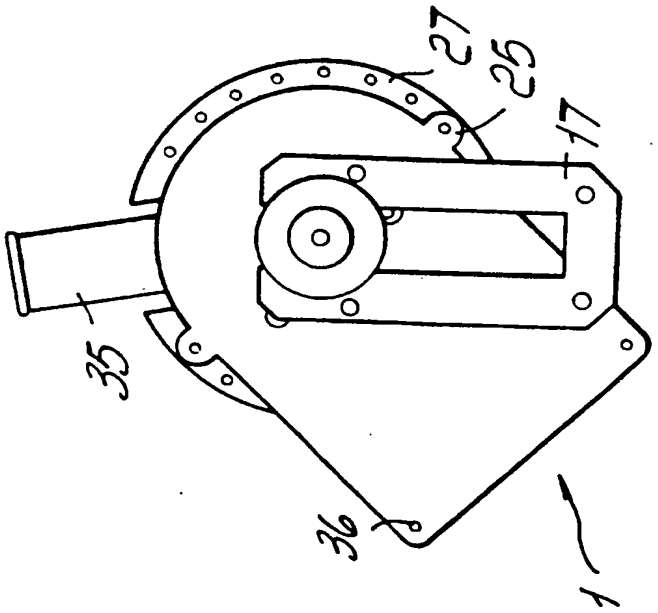

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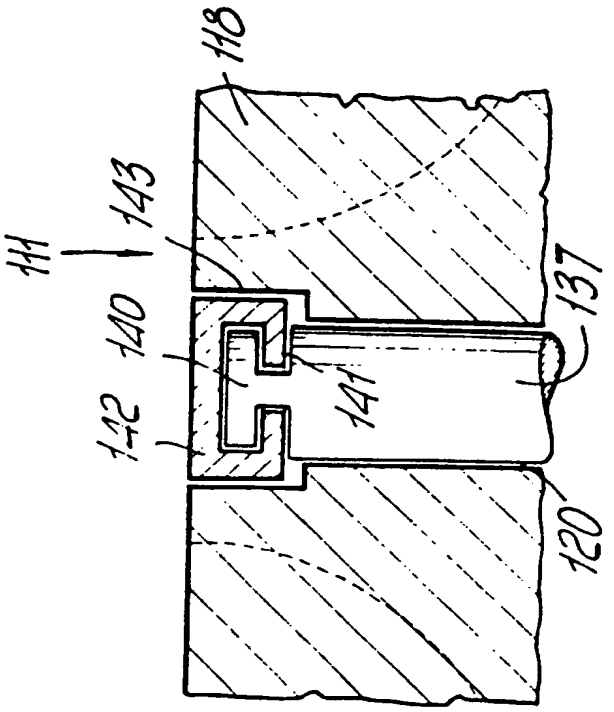
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Fig. 7

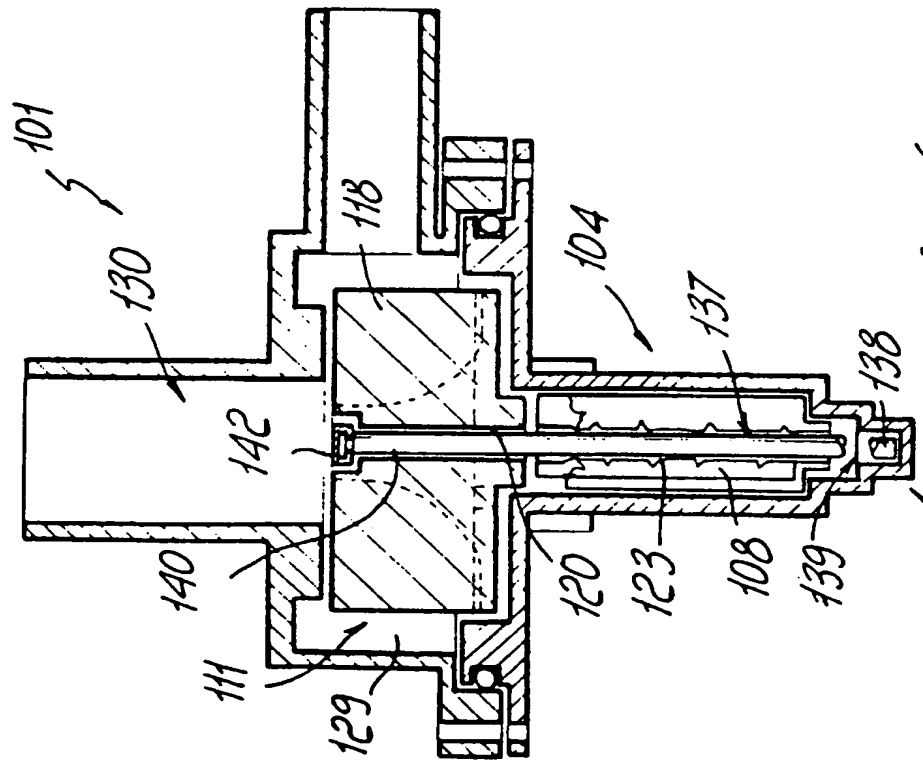
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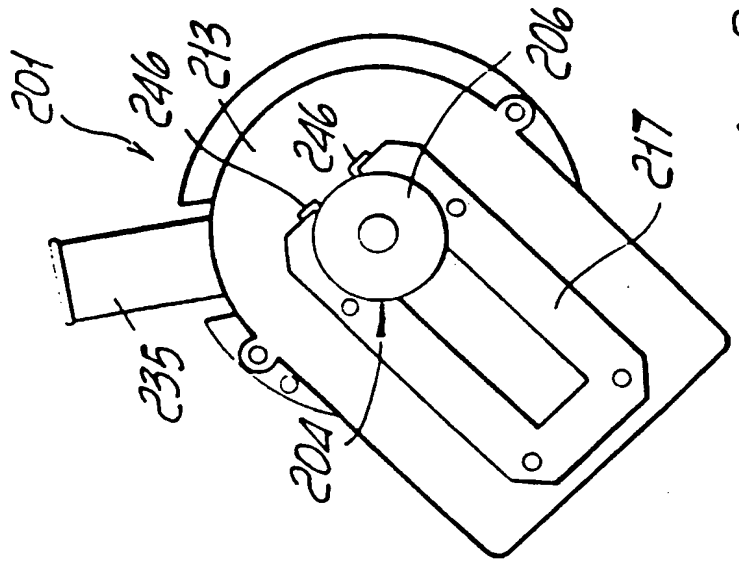
Fig. 6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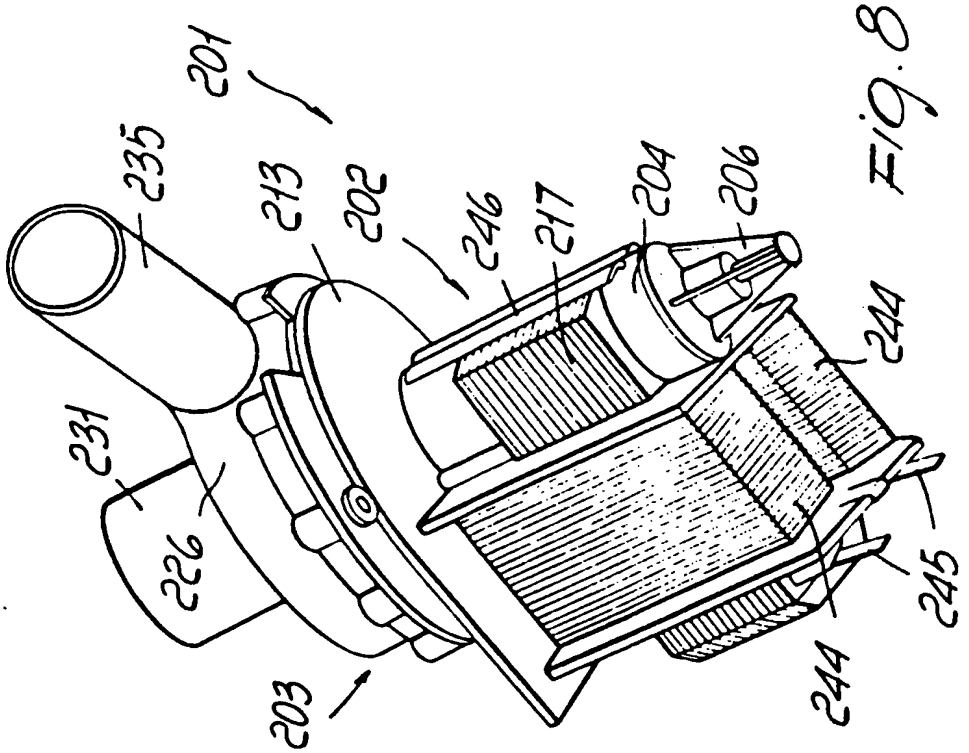
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Fig. 8

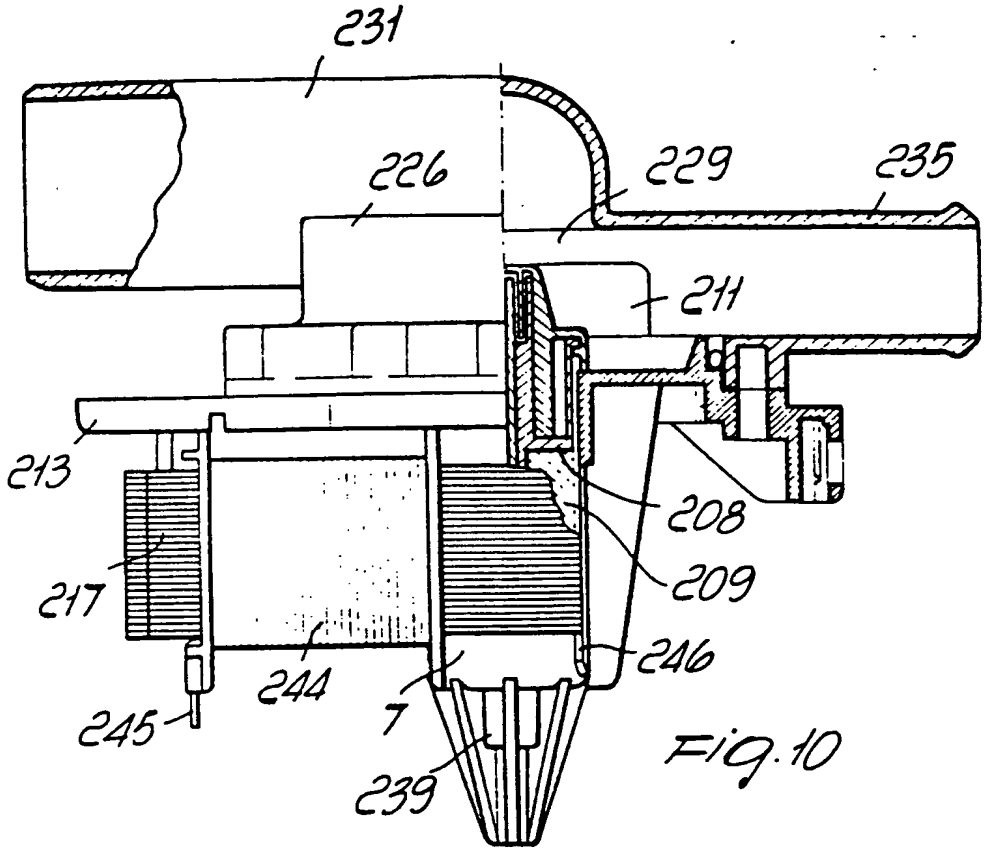
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Fig. 10

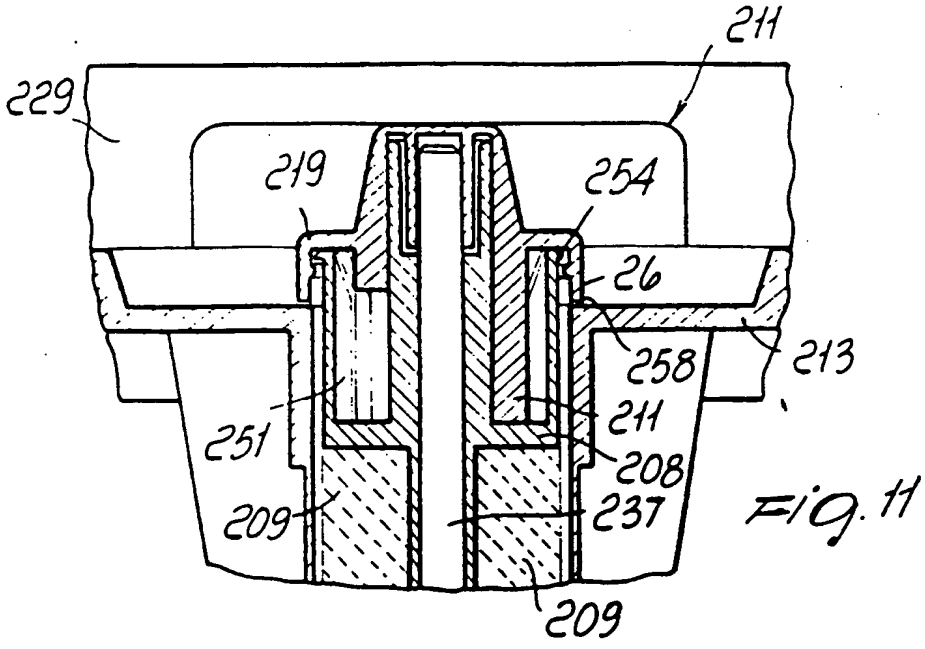
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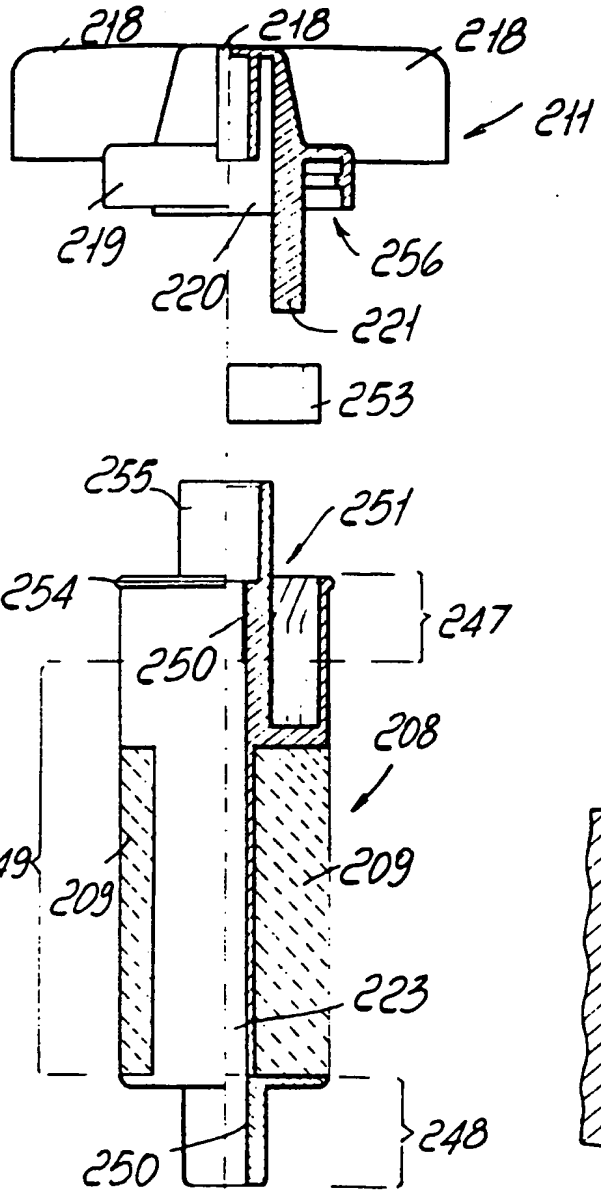
Fig. 11



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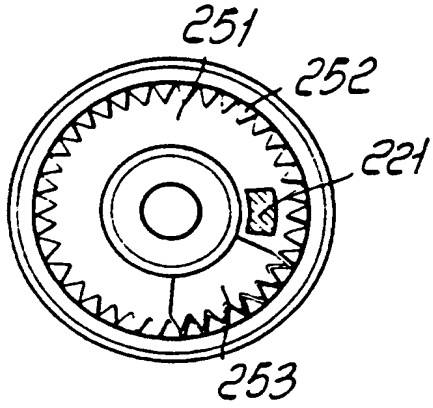

Fig. 13

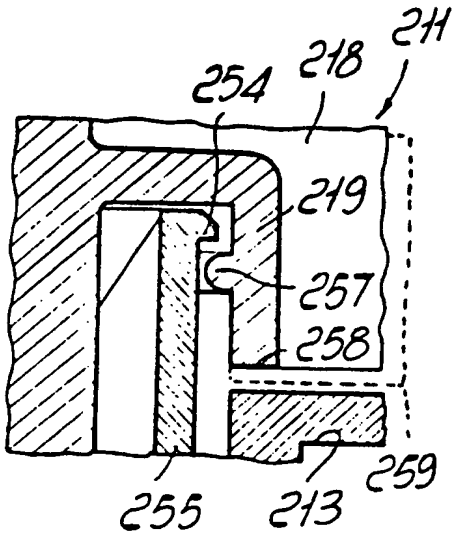

Fig. 14

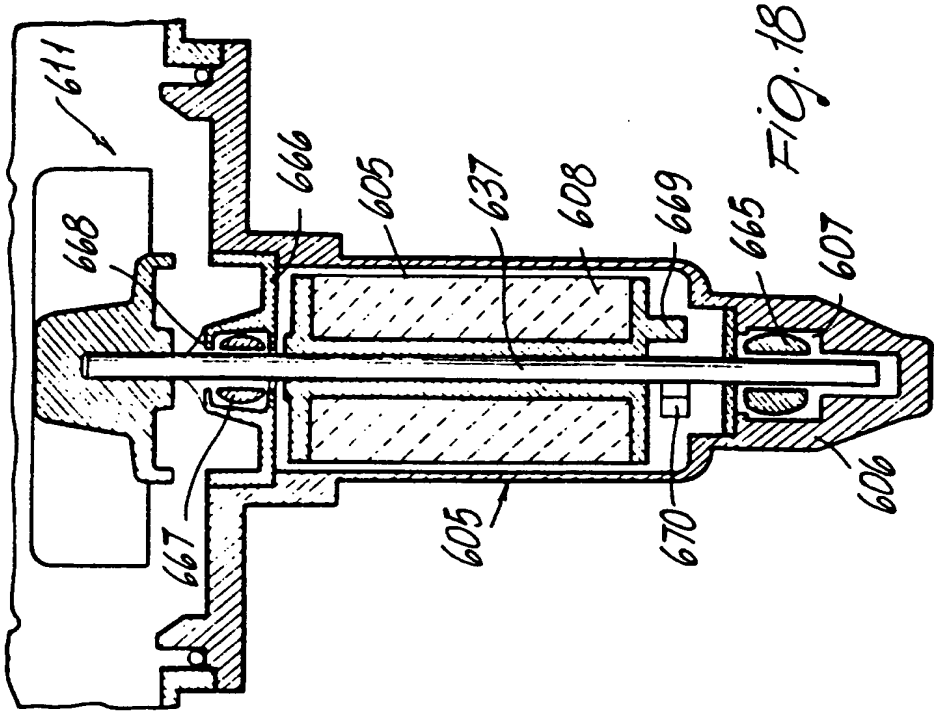
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Fig. 18

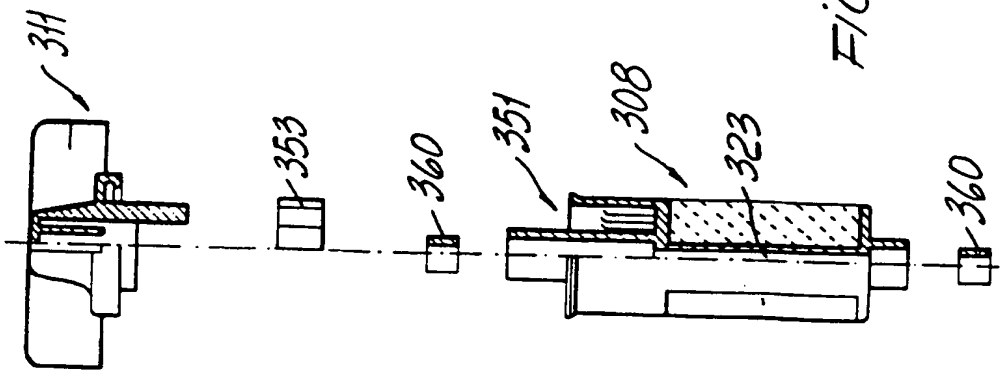
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Fig. 15

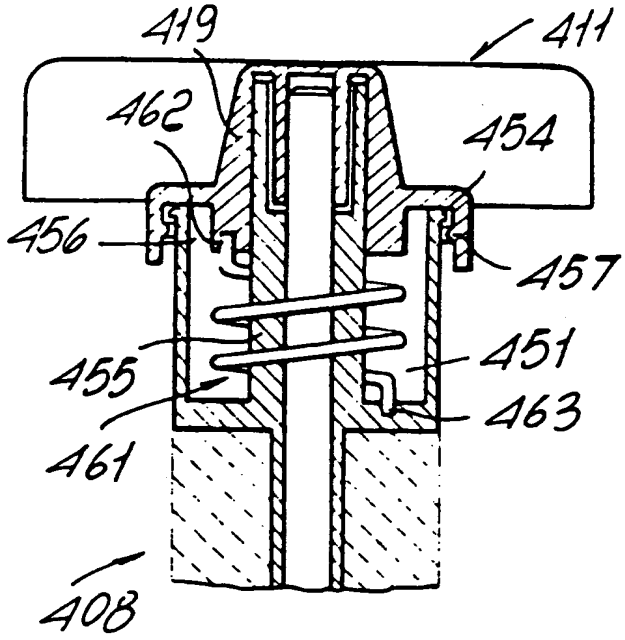

FIG. 16

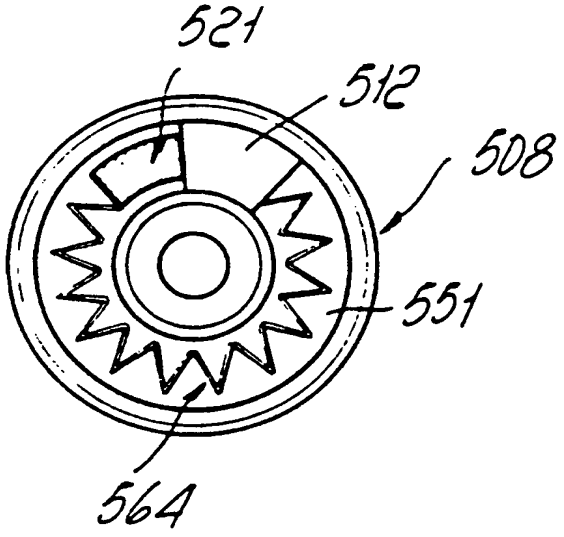

Fig. 17